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Prevalence of home birth among 880,345 women in 67 low- and middle-income countries: A meta-analysis of Demographic and Health Surveys

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ABSTRACT

Objective: The objective of this study was to determine the prevalence of home birth in low-middle income countries (LMIC) according to geographic area and sociodemographic characteristics between 2000 and 2019.
Methods: A meta-analysis was carried out using the most recent demographic and health surveys as a data source (total countries: 67). A random-effects meta-analysis was obtained to calculate pooled prevalence estimates of home birth for all the countries included and by geographic region of the world. Likewise, a subgroup analysis was performed to estimate the prevalence of home birth according to the sociodemographic factors considered for this study.
Results: The global prevalence of home birth was 28% (95% CI: 0.24–0.33), with the lowest prevalence in the region of Europe & Central Asia (5%, 95% CI: 0.03–0.07) and the highest in East Asia & Pacific region (38%, 95% CI: 0.26–0.51). Twelve countries had proportions of home births greater than 50% (seven belonged to the Sub-Saharan Africa region). The countries with the highest proportion of home births were Chad (78%), Ethiopia (73%), and Niger and Yemen (70% each). Concerning the wealth index, in general, the richest quintile (quintile 5) presented the lowest proportion of home births. In contrast, the poorest (quintile 1) generally had the highest prevalence of home births. Regarding educational level, women without education presented the highest proportions of home births in general. In relation to the area of residence, in almost all the countries studied, women in rural areas generally had a higher proportion of home births than those in urban areas.
Conclusions: Home births occurred in approximately 3 out of 10 women in LMIC. There are also differences in the proportion of home births according to socioeconomic factors such as educational level, wealth index, and rurality.

1. Introduction

During the past decades, the world has witnessed an increase in institutional births attended by skilled health care workers, rising from 62% to 80% of births attended by qualified personnel (World Health Organization, 2017). The risk of obstetric complications has been reported to decrease in deliveries assisted by trained health workers. In this regard, the Sustainable Development Goals (SDG) were established as part of the maternal mortality target reduction indicator (3.1, less than 70 deaths per 100,000 live births) to increase the proportion of births attended by skilled health care workers (World Health Organization, 2018). This goal is highlighted in low and middle-income countries (LMIC), which present almost all maternal deaths in the world (World Health Organization, 2018).

During the last decades, one of the many strategies of the World Health Organization to improve maternal health in LMIC has been to enforce institutional delivery, providing support to hospital-based deliveries, given they would yield better maternal and neonatal outcomes. Conversely, there have been recommendations toward home deliveries in high-income countries during the last years, arguing that adequately

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and skilled personnel attended home deliveries, which ensures hospital referral in case of complications, would have similar maternal and neonatal results compared to birth in health centers (ACOG, 2017; National Health Service, 2020). This suggests that a birth attended at home with adequate care by qualified health personnel or trained midwives ensures timely access to a hospital center in case of complications and would have maternal and newborn health outcomes similar to those reported in care of scheduled hospital deliveries (Birthplace in England Collaborative Group, 2011). This highlights the dilemma regarding the place of delivery, with unplanned outside the health center deliveries tending to be associated with adverse maternal and perinatal outcomes.

Unlike developed countries, a significant proportion of home births has been reported in LMIC. In these countries with deficient health systems and scarce allocation of public health services, high home birth rates have been explained by different personal preferences and structural barriers for accessing health services by pregnant women (Adatara et al., 2019). Maternal and neonatal deaths, as well as obstetric complications, have been related to home births attended by non-skilled individuals and births in which health workers are unable to reach women's homes (Ajaari et al., 2012; World Health Organization, 2020). Given that most maternal and neonatal complications are preventable, several initiatives have placed birth institutionalization as well as health workers and community-aimed training at the center of their efforts to achieve safe home births (World Health Organization, 2020).

In LMIC, home birth care is not necessarily available from health systems, being related to cultural and sociodemographic factors of the communities (Montagu et al., 2011). The lack and unavailability of this service, as well as cultural and sociodemographic factors, facilitate the occurrence and high prevalence of this phenomenon in LMIC. Hence, the institutionalization of childbirth strategies aimed at providing access to delivery care in a health facility with adequate infrastructure and medical personnel to ensure quality care should be evaluated (Harvey et al., 2007). This is a priority since the fear of childbirth care in a health center continues to be one of the main motivations for women opting for home delivery care (Ibáñez-Cuevas et al., 2015). Furthermore, birth institutionalization strategies should not follow a one-size-fits-all type of solution, but rather a regional, country and sub-population-specific approach is needed, in which health system readiness and access play an essential role towards countries achieving the 2030 SDGs.

Several nationwide studies on the estimation of health outcomes have been carried out using Demographic and Health Surveys (DHS) as a secondary data source (Short Fabic et al., 2012). These surveys follow standardized procedures and methods, which enable diverse health outcomes in LMIC to be measured and to assess the progress of health indicators within and between countries (The DHS program, 2020). Taking into account that the DHS data collection includes information on sexual and reproductive health among childbearing-age women, these surveys represent a rich source for maternal health research (Akombi & Renzaho, 2019; Issaka et al., 2017; Kyu et al., 2013; Yisma et al., 2019). To date, some publications have reported the prevalence and behaviors related to home birth in LMIC as well as the associated factors (Kifle et al., 2018; Scott et al., 2018). However, no prior study has presented aggregated national-level prevalence estimates for home birth at the geographic, educational, socioeconomic, or residential-specific levels. Thus, this study aimed to estimate the prevalence of home birth in LMICs according to their geographic area and sociodemographic characteristics using national DHS data.

2. Materials and methods

2.1. Data source

We used the most recent DHSs from each country as secondary data sources. These surveys are available through the DHS program website. We obtained data from 67 countries for the period 2000–2019. We choose this time range to account for a considerable number of countries in our analysis, considering that 57 out of the 67 obtained datasets were collected in the year 2010 or after. Using the World Bank regional classification, the countries were assigned according to the following geographic locations: East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East & North Africa, South Asia, and Sub-Saharan Africa.

The DHS Program provides on-request public access to their data via an application programming interface (API), with which microdata for each country could systematically be downloaded. Further details regarding the DHS survey methodology and complex sampling can be reviewed on the DHS program website (https://dhsprogram.com/methodology/). In short, DHSs follow standardized data collection procedures by employing similar questionnaires across different countries, allowing comparability between countries regarding the variables specifically studied (The DHS program, 2020). Regarding the limitations of the DHSs datasets, it includes reporting and recall bias, particularly for retrospective data relying on memory of a past event.

2.2. Inclusion criteria

Most of the recent DHS datasets for each country in which complete information regarding place of birth and other birth-related variables were available, were included in this study. Thus, our final dataset included birth-related country-specific data from 67 countries.

2.3. Variables

The place of birth finalization was our outcome variable. To build this variable, we recoded the DHS variable "M15", which asked women the birthplace of their children younger than five years old. This is a standardized two-digit variable, where the first digit represents a location-specific category, and the second digit describes the detail of that location (e.g., "11" describes the respondent's home and "12" represents somebody else's home). We created a dichotomic value from this variable. Having "1" as the first digit in the Surveys' M15 variable, we considered our place of delivery variable as "Home Birth", thus coding it as "1". Inversely, if the birth category location was not 1, we recoded our variable as "0". As homebirth, woman's home ("11"), other's home ("12"), and traditional birth attendants' premises ("13") were considered.

To address the within-country sociodemographic differences, we added further stratifying variables to the analysis: residence area (urban, rural), wealth index quintiles (Q1: poorest, Q2: poor, Q3: middle, Q4: rich, Q5: richest), and educational level (no education, primary, secondary, higher).

2.4. Data analysis

The reporting of results was conducted following the GATHER (Guidelines for Accurate and Transparent Health Estimates Reporting) guidelines (GATHER, 2021).

DHSs data extraction was done with the R statistical software version 4.0, using the rDHS package (Watson et al., 2019). General and sociodemographic country-specific estimates of the proportions of home births were obtained using the *srvyr* R package, in which complex sampling design and weighting were considered. For stratified estimates, we constructed dumbbell plots to display the within-country difference in home birth prevalences. All estimates were obtained with their corresponding 95% confidence intervals (CI). The statistical code used for estimations is publicly available online (https://github.com/horaciochacon/rdhs_home_births).

Then, the weighting number of home birth and births were extracted from the respective DHS of each country. To calculate the pooled general and geographic region-specific prevalence of home birth, we ran a random-effects meta-analysis. We opted to use a random-effects meta-analysis given that this one accepts heterogeneity among studies, which

would be expected since the different countries assessed have different per-capita incomes and different demographic compositions. Likewise, when testing for heterogeneity with the I^2 test, we found a high level of heterogeneity ($I^2 > 90\%$ for the general and region-specific level). Forest plots were obtained with the *meta* Stata version 17 (Stata Corporation) command. Each forest plot showed the proportion of home birth in individual countries, its corresponding weight, as well as the pooled proportion across each sub-region, and its associated 95% CI. To evaluate the stability of the results and to test whether one country had an undue influence on the meta-analysis, a leave-one-country-out sensitivity analysis was performed (StataCorp LLC, 2021).

2.4.1. Ethical considerations

This study employed freely accessible unidentified datasets. One of the authors (HCT) requested approval from the DHS Program/ICF International to download and use the dataset for all the countries analyzed in the study.

3. Results

Of the 84 DHS eligible LMIC, only 67 had complete and available data from 2000 onwards (Fig. 1). Fourteen country surveys were excluded from the analysis since they were conducted before the year 2000. Although the datasets for the 2000–2019 period in the Ukraine, Nicaragua, and Vietnam were available, they contained inconsistencies in the stratifying variables and different coding, which did not allow their inclusion in the analysis. The final dataset included information about 888,513 births from 636,334 women interviewed in 588,070 households.

Regarding country-specific estimates, the proportion of home births was higher than 50% in 12 countries, with seven countries belonging to the Sub-Saharan African region. The countries with the highest prevalence of home birth were Chad (78%, 95% CI: 0.77–0.79), Ethiopia (73%, 95% CI: 0.73–0.74), Niger (70%, 95% CI: 0.69–0.71), and Yemen (69%, 95% CI: 0.69–0.70), the first three being from the Sub-Saharan African region and the last from the Middle East & North Africa region. In Europe & Central Asia, the region with the lowest proportion of home birth, Azerbaijan showed the highest prevalence of home birth (22%, 95% CI: 0.20–0.24), while the remaining countries in the region had proportions of less than 15% (Fig. 2). Concerning the other geographic regions, the highest proportions of home birth were reported in Myanmar (East Asia & Pacific) with 63% (95% CI: 0.61–0.64), Haiti (Latin America & Caribbean) with 60% (95% CI: 0.59–0.61), and Afghanistan (South Asia) with 51% (95% CI: 0.51–0.52).

Fig. 2 shows a forest plot of the prevalence of home birth in 67 LMIC and by geographic region. The global prevalence of home birth was 28% (95% CI: 0.24–0.33). Regarding home birth according to geographic regions, the lowest prevalence was found in Europe & Central Asia (5%, 95% CI: 0.03–0.07), and the highest was described in East Asia & Pacific countries (38%, 95% CI: 0.26–0.51). For the remaining regions, the prevalence of home birth was the following: Latin America & Caribbean (21%, 95% CI: 0.11–0.32), Middle East & North Africa (31%, 95% CI: 0.02–0.60), South Asia (33%, 95% CI: 0.19–0.48), and Sub-Saharan Africa (31%, 95% CI: 0.25–0.39). By regions, only Europe & Central Asia had a lower estimated average prevalence than the rest of the regions.

Overall, the richest quintiles (Q5) had the lowest proportions of home birth in relation to wealth quintiles. Conversely, the lowest quintiles (Q1) presented, on average, the highest prevalences of home birth. In most countries, lower quintile estimates (Q1 and Q2) had higher proportions of home birth than the country's average (Fig. 3).

It was found that women without education had the highest proportion of home births. Additionally, the gap between the lowest educated and the highest educated women in relation to the prevalence of home birth was large among most countries. For instance, in Chad and Haiti, the difference in prevalence between women with no education and higher education was 76% and 77%, respectively. Furthermore, when we examined the education-specific estimates of several countries which had average home birth prevalences lower than 25%, the prevalence of home birth among women with no education showed an out-of-the-trend prevalence in countries such as the Philippines (74%), Honduras (45%), Peru (47%) and Namibia (40%). Overall, country-specific estimates showed that the least educated women had higher proportions of home deliveries and, inversely, highly educated women had lower home birth rates (Fig. 3).

In most of the country-specific estimates regarding urban and rural differences, it was found that rural-dwelling women presented lower proportions of home birth. This absolute rural-urban gap was more extensive in Niger, Ethiopia, Timor-Leste, Angola, Morocco, Guinea, and Bolivia, with a difference of at least 40% in the prevalence between rural and urban home birth (Fig. 3).

We also conducted a leave-one-out sensitivity analysis to further examine if any single country included in the meta-analysis might have a significant impact on the pooled results. This analysis resulted in a pooled estimated proportion ranging between 0.27 (95% CI 0.22–0.32) and 0.28 (95% CI 0.23–0.33) after the deletion of a single country (Supplementary Figure 1). This finding indicates that our findings were robust and not dependent on a single country.

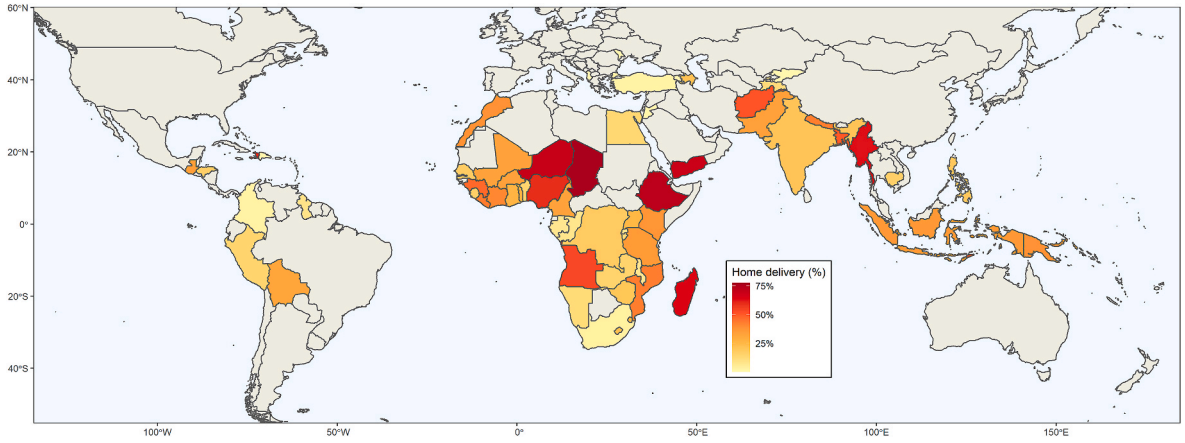

Fig. 1. Map of 67 low-middle income countries included in the analysis. The map of the world is shown with the information of home delivery prevalence in a yellow-red gradient colour palette (n = 67). Countries, where no information was obtained, are shown in light green. The world map was constructed with the *rnaturalearth* and *sf* R packages. Source: DHS Program. . (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

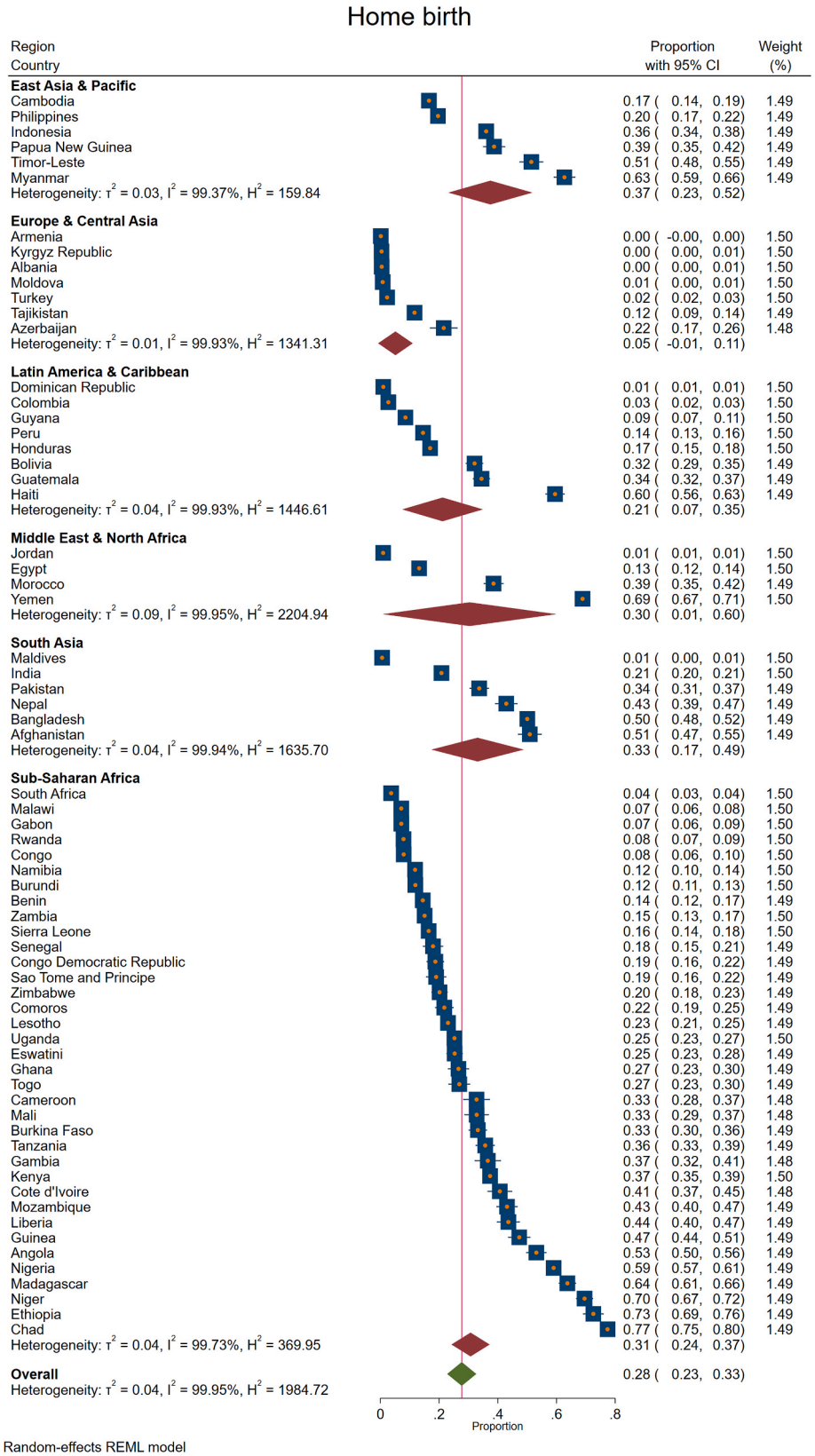

Fig. 2. Forest plot of the meta-analysis of prevalence of home birth in 67 low-middle income countries. Countries are sorted in descending order of prevalence of home birth by region. Complex sampling design and weighting were considered in analyses. Pooled estimates are from random-effects meta-analyses.

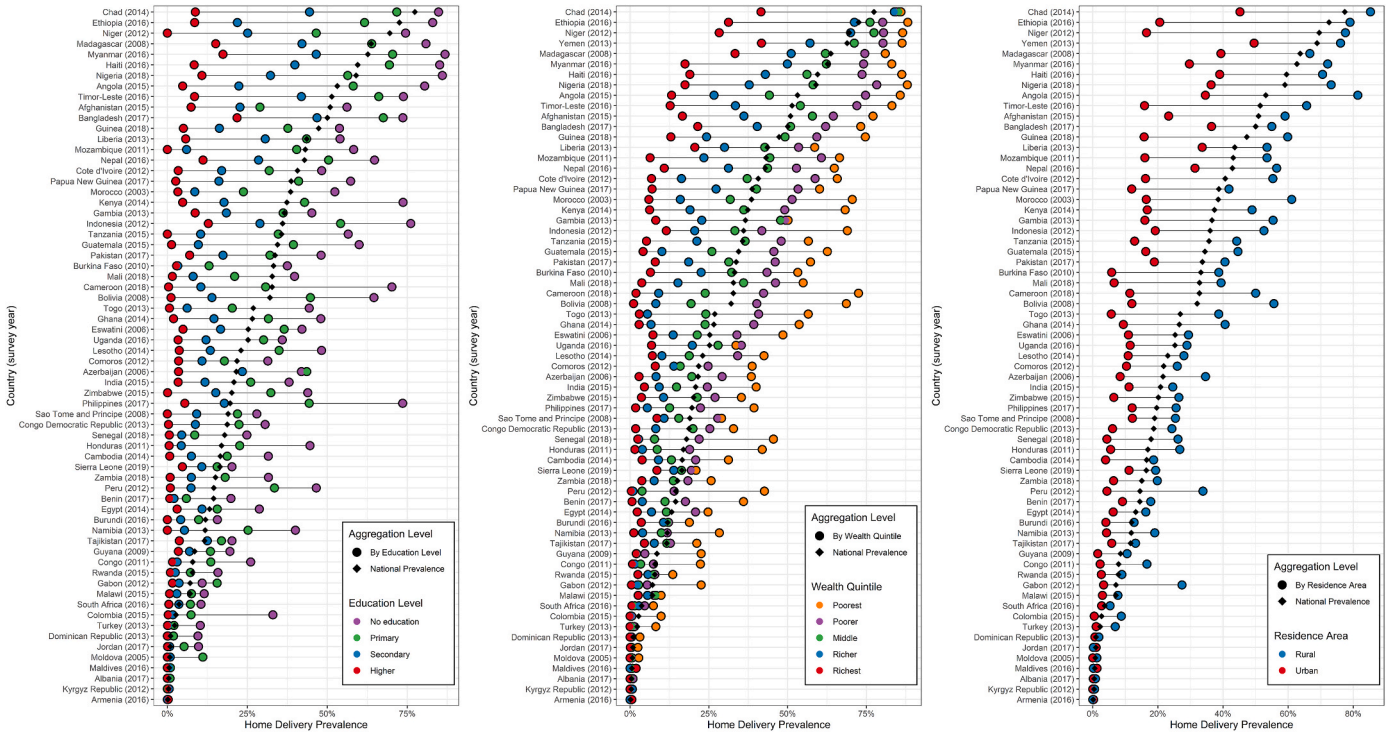

Fig. 3. Prevalence of home birth according to (A) educational level, (B) wealth quintile, and (C) area of residence. Dumbbell plots of home delivery prevalence in 67 low- and middle-income Demographic and Health Survey countries by educational level (left), wealth quintile (middle), and area of residence (right). The country-level prevalence is plotted along the x-axis in colored circles next to the country average in the diamond shape. Countries are sorted in descending order by their average home delivery prevalence. The year of the survey is displayed in parentheses after the country name.

4. Discussion

This study aimed to obtain country-specific and pooled estimates of the prevalence of home birth for 67 LMIC belonging to six World Bank regions (East Asia & Pacific, East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East & North Africa, and South Asia). Heterogeneous country-specific home birth prevalences were found within the same regions, which indicated that, on average, almost three out of every ten women gave birth at home. The findings also show that in 12 out of the 67 reported countries (17%), the proportions of home birth were 50% or more, most of which belonged to Sub-Saharan African countries. Furthermore, women with low educational levels, rural dwellings, and those belonging to lower socioeconomic quintiles, had a significantly higher prevalence of home births.

This study detected a high prevalence of home births among LMIC within the study period (3 out of 10 births were attended at home). Several births and health service-related sociodemographic factors have been described to be associated with non-institutional home births in LMIC (Muluneh et al., 2020). In addition, factors associated with home birth, such as lack of a birth plan, incomplete antenatal care (ANC) visits, and women's preference for a home birth, have been described (Chernet et al., 2019). The most significant proportion of adverse maternal outcomes occur in LMIC, which present almost all the maternal deaths reported worldwide (94%) (World Health Organization, 2015). Unlike high-income countries, the bulk of home deliveries in LMIC are attended by non-skilled individuals who are usually traditional birth attendants (TBA), increasing the risk of complications during child labor (Montagu et al., 2011). There is, therefore, a need to enhance efforts to reduce home births in LMIC with weak health systems, and in which home birth care is not framed within the structure of health systems, producing a lack of protection for pregnant women.

Regarding regional findings, all the regions evaluated, with the exception of Europe & Central Asia and Latin America & Caribbean, reported pooled home birth prevalences higher than 30%. All regions, except Europe & Central Asia, reported at least one country with a home birth prevalence of 50% or higher, with the Sub-Saharan region including the most countries with this high prevalence. In 2017, 86% of all maternal deaths in the world took place in Sub-Saharan Africa (66%) and Southern Asia (20%). Sub-Saharan countries have been described as having non-skilled birth attendants and health care access barriers as determinants of adverse maternal and neonatal outcomes. In Sub-Saharan African countries, such as Tanzania, a high proportion of births are attended at home by non-qualified providers such as TBA, siblings, or neighbors, and it has been described that a lack of formal education, scarce telecommunication access, low acceptance to ANC services, low socioeconomic status, and geographic location were all related to the choice of home over institutional birth (Moshi & Mbotwa, 2020). In Bangladesh (South Asia region), another country with a high proportion of home births, low family-perceived importance of institutional delivery, financial constraints, fear of cesarean section, and husbands not allowing delivery at health establishments were associated with having births at home (Perkins et al., 2019). In general, LMICs present the highest proportions of home births and share the presence of factors that increase the probability of home birth care.

In the region with the lowest proportion of home births, that is, Europe & Central Asia, Azerbaijan was found to have the highest estimated home birth rate with a prevalence of 22%, followed by Tajikistan with 12%. All the remaining Europe & Central Asia countries showed country-specific prevalences lower than 5%. In some low- and middle-income ex-USSR central Asian countries, such as Tajikistan, maternal outcomes have worsened compared to during the Soviet era, in which social safety nets provided high human development indicators, despite low gross domestic product levels (World Health Organization, 2015). Similarly, European LMIC presented the lowest proportions of home birth. Unsurprisingly, these also ex-USSR middle-income European countries, such as Albania, had the best home birth rates among the countries studied in this region. Robust health systems and cultural factors could be the main drivers of higher institutional delivery rates in

this region compared to other LMIC.

An important finding was that the highest country-specific estimates of the proportion of home births were found among women with little education. This finding was ubiquitously found in all regions, and while strata-specific home birth proportions varied considerably between the least educated women and the countries on average, almost all countries (63 out of 67) presented home birth rates of less than 12.5% among highly educated women. A low educational level has been described as a driver of home birth, as educated women tend to search for hospital-based care, explained by understanding and knowledge about the risk that birth encompasses (Tiruneh et al., 2020). Higher fertility rates among low-educated women put them at higher risk of adverse birth outcomes, in addition to the risk of being attended by non-skilled personnel or TBA. Likewise, women with a lower educational level have a higher probability of complications in relation to home birth care not performed by qualified medical personnel or trained midwives, as well as at the hospital level (Karlsen et al., 2011; Tunçalp et al., 2014). Moreover, research has shown that a higher education level of the head of the household – which in LMIC tends to be the men – is also associated with a lower likelihood of home birth (Tiruneh et al., 2020; World Health Organization, 2015). Although the specific pathways leading from higher maternal education towards improved maternal health are still unclear (Mensch et al., 2019), key global health institutions have modeled the importance of maternal education in achieving good maternal and neonatal health outcomes (Karlsen et al., 2011; Kassebaum et al., 2016). Country and regional specific peculiarities are likely to present and need to be further researched. However, LMIC should emphasize the need to address social determinants of health, such as education and gender equity, which would ultimately facilitate the closing of the home delivery birth gap that is presently described.

Regarding the wealth quintile, the richest women presented the lowest proportions of home birth. The literature describes that high socioeconomic status is associated with access to ambulatory birth care, thus explaining this finding (Chernet et al., 2019; Sanogo & Yaya, 2020; Tiruneh et al., 2020). Similar to highly educated women, those among the top wealth quintiles exhibited lower home birth rates, although the difference between the lowest and highest quintiles was on average narrower than that seen in the strata-specific estimates of educational level. In this regard, women with a low level of education and low socioeconomic status have historically been relegated from maternal health care, whether because of geographical, economic, or cultural barriers. Likewise, several studies have described that women with low educational or socioeconomic levels presented a higher proportion of adverse maternal and neonatal outcomes (Karlsen et al., 2011; Tunçalp et al., 2014). Given the current worldwide COVID-19 economic and social burden, it remains to be seen how these financial consequences will affect access to maternal health services access. However, LMIC must consider underserved and extremely poor populations since these are the most likely to be affected by a disruption in the uptake of maternal services.

On the other hand, our results show that rural-dwelling women presented higher proportions of home birth than urban-dwelling women. This finding coincides with prior studies in different countries that described a higher prevalence of home birth among women in rural settings. Rurality has been described as a factor associated with lower health care access, including maternal health care services (Kozhimannil et al., 2016; Nuamah et al., 2019; World Health Organization, 2013). Furthermore, rurality is frequently associated with physical and cultural barriers to maternal health services (Adatara et al., 2019; Sialubanje et al., 2015). Rural women are also likely to present adverse maternal and perinatal outcomes since low access to health centers configures a complicated scenario if evacuation or specialized care is required. In this context, community-based referral systems that are adequately linked to the health system have been put in place in relation to maternal health in order to overcome dispersion and hard-to-reach rural populations. The scenario described highlights the need to establish a community structure that allows the best possible quality of delivery care and the necessary means for transporting pregnant women in communities where home birth represents a high proportion of all deliveries.

Among the limitations of the present study, the cross-sectional design of the DHS prevents causal inferences from being established. Additionally, memory bias in the self-reporting of variables could introduce a bias in our data interpretation. Furthermore, the availability of DHS from LIMC in different years limits direct comparability between countries and among regions. Also, some characteristics, including the intention or perception of the woman regarding the home birth attention, whether by qualified personnel or not, were not collected by the survey. This scenario limits the characterization of the home birth topic in LMIC. Finally, despite these limitations, we consider that the use of a large and representative sample of national DHS data from LMIC, with quality control processes, and widely used for the study of maternal health in LMIC, is useful to establish a baseline for the study of home births in LMIC.

In conclusion, approximately 3 out of 10 women in LMIC deliver at home, with different proportions of home births between countries in the same region. On the other hand, in some countries, less than one woman in 10 gave birth at home, while in others, home birth was reported in 7 out of 10 women. Likewise, differences were found in the proportions of home births according to socioeconomic factors such as educational level, wealth index, and rurality. Thus, some population subgroups in LMIC present higher proportions of home births.

This study added to the literature estimates about the prevalence of home birth in LMICs using World Bank regional geographic locations and prevalence according to sociodemographic characteristics. Almost the entire burden of maternal mortality and other maternal and child health outcomes is borne by LMICs, which also have weak health systems and part of their population prefers home birth care for cultural reasons. For this reason, these countries could benefit from the evaluation and implementation of programs to increase access to hospital birth care as well as home birth care by qualified personnel in population subgroups in whom home births are not attended in this way. Moreover, greater focus should be given to the regions of the world with the highest proportions of home births, such as in countries of the Sub-Saharan Africa region, where the highest proportions of home births occur.

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Declarations of interest statement

None.

CRediT authorship contribution statement

Akram Hernández-Vásquez: Conceptualization, Methodology, Formal analysis, Data curation, All the authors, Writing – original draft, preparation, Writing – review & editing. **Horacio Chacón-Torrico:** Conceptualization, Methodology, Formal analysis, Data curation, All the authors, Writing – original draft, preparation, Writing – review & editing.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.

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